



AEROSPACE STANDARD

AS6070™**REV. A**Issued 2015-01
Revised 2020-10

Superseding AS6070

(R) Aerospace Cable, High Speed Data, Copper

RATIONALE

This was a complete revision change required to clarify and correct requirements.

Revision required to correct spelling and typographical errors, add three AS6070 detail specifications to the list of SAE publications, deleted specifications which were no longer referenced; added AS29606 Type SCC annealed copper conductor; and added NEXT, NEXT on mandrel, PS-NEXT, ACR-F, PSACR-F and Return Loss testing to the Retention of qualification list of testing to be conducted by the Qualifying Activity.

1. SCOPE

This standard covers jacketed multi-conductor copper data cables for aerospace use.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AS4373	Test Methods for Insulated Electric Wire
AS5768	Tool, Stripper, Electrical Insulation, General Specification For
AS5768/1	Tool, Stripper, Manually Actuated, Electrical Insulation, Round Wire, Size 10 To 30
AS5768/2	Tool, Stripper, Manually Actuated, Small Grip, Electrical Insulation, Round Wire, Size 16 To 30
AS6070/1*	Cable, High Speed Data Quad, 24 AWG Copper Alloy, 100 Ohm, 200 °C, Ethernet 10/100 Base T
AS6070/2*	Cable, 4 Pair 24 AWG Copper Alloy, Shielded, 100 Ohm, 200 °C, Ethernet 1000 Base T
AS6070/3*	Cable, High Speed Data Quad, 24 AWG Copper Alloy, 110 Ohm, 200 °C

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SAE WEB ADDRESS:

Full document details: [SAE AS6070A](http://www.sae.org/standards/content/AS6070A)

For more information on this standard, visit
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Documents
Document Sharing Hub

AS6070/4*	Cable, 4 Pair 24 AWG Copper Alloy, Shielded, 100 Ohm, 150 °C, Ethernet 1000 Base T
AS6070/5*	Cable, High Performance, 4 Pair, Shielded, 100 Ohm, 200 °C, Ethernet 1000 Base T
AS6070/6*	Cable, High Performance, 4 Pair, Shielded, 100 Ohm, 200 °C, Ethernet 10g Base T
AS6070/8*	Cable, Lightweight Optimized High Speed Data Quad, 110 Ohm, 200 °C
AS9100	Quality Management Systems - Requirements for Aviation, Space and Defense Organizations
AS29606	Wire, Electrical, Stranded, Uninsulated Copper, Copper Alloy, or Aluminum, or Thermocouple Extension, General Specification For

*AS6070 detail specifications

2.1.2 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

MIL-STD-104 Limit for Electrical Insulation Color

MIL-STD-202 Test Method Standard - Electronic and Electrical Component Parts

SD6 Provisions Governing Qualification

2.1.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D4566 Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable

2.1.4 National Conference of Standards Laboratories (NCSL) Publications

Available from NCSL International, 2995 Wilderness Place, Suite 107, Boulder, CO 80301, Tel: 303-440-3339, www.ncsli.org.

NCSL Z540.3 Requirement for The Calibration of Measuring Test Equipment

2.1.5 ECIA Publications

Available from Electronic Components Industry Association, 2214 Rock Hill Road, Suite 265, Herndon, VA 20170, Tel: 571-323-0294, www.ecianow.org.

ECA EIA-364-108 Impedance, Reflection Coefficient, Return Loss, and VSWR Measured in the Time and Frequency Domain Test Procedure for Electronic Connector, Sockets, Cable Assemblies Or Interconnect Systems

2.2 Definitions

ATTENUATION: The degradation of signal amplitude along a cable length due to losses in the cable. Attenuation (dB) = $20 \log (v_1/v_2)$.

ATTENUATION TO CROSSTALK RATIO-FAR END (ACR-F): (Formerly known as EQUAL LEVEL FAR END CROSSTALK, ELTEXT): A measure of far end crosstalk which accounts for the effects of cable attenuation.

BANDWIDTH: the range of electrical frequencies that a transmission line can effectively handle. The maximum data rate for a given system (see Attenuation to Crosstalk Ratio).

CAPACITANCE, MUTUAL: The capacitance between two conductors of a pair with all other conductors and shield grounded.

CAPACITANCE, UNBALANCE: A measure of the inequality of capacitance between conductors of two adjacent pairs.

CAPACITANCE, UNBALANCE TO GROUND: A measure of the inequality of capacitance between the ground capacitance of two conductors of a single pair.

CATEGORY 5: A 4-pair cable with transmission characteristics specified up to 100 MHz.

CATEGORY 5e: A 4-pair cable with transmission characteristics specified up to 100 MHz. Tests in addition to those for Category 5 are added to ensure the capability to handle Gigabit Ethernet and all lesser Categories.

CATEGORY 6: A 4-pair cable with transmission characteristics specified up to 250 MHz to support Gigabit Ethernet and all lesser Categories.

CATEGORY 6a: A 4-pair cable with transmission characteristics specified up to 500 MHz to support 10G Ethernet and all lesser Categories.

CATEGORY 7: A 4-pair cable with transmission characteristics specified up to 650 MHz to support 10G Ethernet and all lesser Categories.

CHARACTERISTIC IMPEDANCE: The measure of a transmission line's curve fit of the input impedance throughout its length at a specific frequency, or over a swept frequency spectrum. Additionally, characteristic impedance can be defined in the time domain where the rise time of the TDR pulse is defined.

COMMON MODE VOLTAGE: In a differential system, the unwanted voltage between each input connection and ground that is added to the voltage of each original signal.

CROSSTALK: The noise induced into a passive pair by an active pair measured in dB. Crosstalk measured from the near end is "NEXT" and from the far end is "FEXT."

DELAY SKEW: The difference in propagation delay between the slowest and fastest pairs in a cable.

DIFFERENTIAL IMPEDANCE: The impedance between the inverting and non-inverting input terminals of a differential amplifier.

DIRECT CURRENT RESISTANCE (DCR) UNBALANCE: The percent difference of DCR between the two conductors of any pair compared to the others.

FAR END CROSSTALK (FEXT): The noise induced into a passive pair by an active pair and measured at the far end.

GIGABIT ETHERNET: Ethernet networking that supports a data rate of 1 Gigabit per second.

IMPEDANCE: The complex opposition to current flow in a transmission line which includes the components of resistance, capacitance, and inductance when driven by a voltage source.

INSERTION LOSS: The signal loss resulting from the insertion of a component between a transmitter and a receiver (often referred to as attenuation).

NEAR END CROSSTALK (NEXT): The noise induced into a passive pair by an active pair and measured at the near end.

POWER SUM: A computation of the total effects of the disturbance to a single pair from all other pairs in a cable.

POWER SUM ATTENUATION TO CROSSTALK RATIO-FAR END (PSACR-F): (Formerly known as Power Sum Equal Level Far-End Cross Talk, PSELFEXT): A computation of the ratio of noise induced into a single pair by all other pairs measured at the far end relative to the received signal on the same pair.

POWER SUM NEAR END CROSSTALK (PSNEXT): A computation of the noise induced into a single pair by all other pairs and measured at the near end.

TIME DELAY (TD): The time it takes for a signal to propagate from one end of a pair to the opposite end of the same pair.

PROPAGATION DELAY SKEW: The time difference in propagation delay from the fastest pair to the slowest.

QUAD: A cable consisting of four separate insulated conductors in which each set of opposing conductors constitutes a differential pair.

QUALIFICATION INSPECTION: Qualification Inspection is a process that demonstrates that a component is capable of fully conforming to all the requirements defined in a standard. Qualification Inspection includes definition of the measurements, tests, analysis, and associated data which provides consistent rationale for acceptance of a particular supplier's design as meeting the standard requirements typically prior to acquisition by the Purchaser.

QUALIFIED PRODUCTS LIST: A Qualified Products List is a list of suppliers whose products have been evaluated to a defined process and who are authorized to provide those products to a purchaser upon request. When a Qualified Products List is specified, only approved suppliers are authorized to provide products under the part number defined in the component standard. A Qualified Products List is established by a Qualifying Activity.

QUALIFYING ACTIVITY: A Qualifying Activity is a function established by a Purchaser or group of Purchasers that has a defined process used to consistently evaluate all suppliers' products in accordance with the component standard.

QUALITY CONFORMANCE INSPECTION: Quality Conformance Inspection is a process which includes measurements, non-destructive tests, analysis, and associated data that will provide verification that a particular individual component continually conforms to the requirements defined in the standard.

PURCHASER: A Purchaser is an individual or group of individuals that can issue a purchase order.

RETURN LOSS (RL): A measure of the ratio of a transmitted signal relative to the reflected signal caused by imperfections and inconsistencies in a transmission line, and is related to input impedance.

SUPPLIER: A Supplier is a manufacturer which has design and production control of the processes used to produce a component.

TWINAX: Cable consisting of two insulated conductors surrounded by an overall shield.

VELOCITY OF PROPAGATION (VP): The transmission speed of an electrical signal down a length of cable compared to its speed in free space expressed in percentage.

3. REQUIREMENTS

3.1 Detailed Specification Sheets

Individual cable requirements shall be as specified herein and in accordance with the applicable detailed specification sheets. In the event of any conflict between the requirements of this standard and the detailed specification sheet, the latter shall govern.

3.2 Qualification

The components shall be a product that has been tested and has passed the qualification tests specified herein, and has been listed on or approved for listing on the applicable qualification products list.

3.3 Physical Characteristics

3.3.1 Construction Description

The multi-conductor cable dimensions and material make up shall be as specified in the applicable detailed specification sheets and measured in accordance with 5.1.1.

3.3.2 Primary Wire and Jacket Color

Unless otherwise specified in the detail specification sheets, the color of the insulation shall be in accordance with MIL-STD-104, Class 1 or shall meet alternate Munsell color limits as specified in Table 1. Alternate Munsell color limits may also be used for laser marking, or transparent jackets, when specified in the detail specification and measured in accordance with 5.1.2.

Table 1 - Alternate Munsell color limits for primary wires and jackets ^{1/}

COLOR	HUE		VALUE		CHROMA	
	FROM	TO	FROM	TO	FROM	TO
BLACK	2.5N	2.5N	7	8.5	N/A	N/A
BLUE	5PB	7.5B	7	8	4	6
GREEN	2.5G	7.5G	7	9	2	6
RED	10RP	5R	7	8	4	6
YELLOW	5Y	10Y	8	9	4	6
BROWN	2.5YR	7.5R	7	9	2	4
ORANGE	10R	2.5YR	6	7	8	10
VIOLET	2.5P	7.5R	7	8	4	8
GRAY	SAME AS BLACK		SAME AS BLACK		SAME AS BLACK	

^{1/}Alternate Munsell color limits are proposed to limit the concentration of color additives which may affect, in some particular cases, performances of the cables in transmission.

3.3.3 Cable Diameter

The outer jacket diameter shall be as specified in the applicable detailed specification sheets and measured in accordance with 5.1.3.

3.3.4 Cable Weight

The maximum cable weight shall be as specified in the applicable detailed specification sheets and measured in accordance with 5.1.4.

3.3.5 Conductors

In accordance with AS29606 Tables 4A and 4C unless otherwise specified.

3.3.6 Conductor material and coating in accordance with AS29606 Type SCA, SCA1, or SCC, unless otherwise specified in the detail specification sheet.

3.4 Electrical Requirements

3.4.1 Attenuation

The maximum attenuation shall be as specified in the detailed specification sheets and shall be measured in accordance with 5.2.1.

3.4.2 Impedance

Impedance shall be tested in accordance with the following methods:

3.4.2.1 Characteristic impedance, when specified, shall be as specified in the detailed specification sheets, and shall be measured in accordance with 5.2.2.

3.4.2.2 Differential Impedance, when specified, shall be as specified in the detailed specification sheets, and shall be measured in accordance with 5.2.3.

3.4.3 Capacitance, Mutual

Mutual Capacitance shall be as specified in the detailed specification sheets and shall be measured in accordance with 5.2.4.

3.4.4 Capacitance, Unbalance

Capacitance Unbalance-Pair to ground shall be as specified in the detailed specification sheets and shall be measured in accordance with 5.2.5.

3.4.5 DC Resistance Unbalance

DC Resistance Unbalance shall be as specified in the detailed specification sheet and shall be measured in accordance with 5.2.6.

3.4.6 Near End Cross Talk (NEXT)

The minimum NEXT shall be as specified in the detailed specification sheets and shall be measured in accordance with 5.2.7.

3.4.7 Near End Cross Talk (NEXT) on Mandrel

The minimum next on mandrel shall be as specified in the detailed specification sheets and shall be measured in accordance with 5.2.8.

3.4.8 Power Sum Near End Cross Talk (PS-NEXT)

PS-NEXT, when specified, shall meet the requirements of the detailed specification sheets, and shall be determined in accordance with 5.2.9.

3.4.9 Attenuation to Crosstalk Ratio-Far End (ACR-F)

ACR-F, when specified, shall meet the requirements of the detailed specification sheets, and shall be determined in accordance with 5.2.10.

3.4.10 Power Sum Attenuation to Crosstalk Ratio-Far End (PSACR-F)

PSACR-F, when specified, shall meet the requirements of the detailed specification sheets, and shall be determined in accordance with 5.2.11.

3.4.11 Return Loss

Return Loss (RL), when specified, shall meet the requirements of the detailed specification sheets, and shall be measured in accordance with 5.2.12.

3.4.12 Propagation Delay (refer to ASTM D4566, Phase Delay)

Propagation Delay, when specified, shall meet the requirements of the detailed specification sheets, and shall be measured in accordance with 5.2.13.

3.4.13 Propagation Delay Skew (refer to ASTM D4566, Phase Delay)

Propagation Delay Skew, when specified, shall meet the requirements of the detailed specification sheets, and shall be determined in accordance with 5.2.14.

3.4.14 Velocity of Propagation (Vp) (refer to ASTM D4566, Phase Velocity)

Velocity of Propagation, when specified, shall meet the requirements of the detailed specification sheets, and shall be measured in accordance with 5.2.15.